MYCOTAXON

ISSN (print) 0093-4666 (online) 2154-8889 Mycotaxon, Ltd. ©2019

*April–June 2019—Volume 134, pp. 261–269*

https://doi.org/10.5248/134.261

# New records of *Amandinea* and *Buellia* from China

Zun-Tian Zhao[1#], Xiao Zhang[1#], Jie-Meng Fu[1], Ling Hu[2*]

[1]*Key Laboratory of Plant Stress Research, College of Life Sciences &*
[2] *Institute of Environment and Ecology*
*Shandong Normal University, Jinan, 250014, P.R. China*

[*]Correspondence to: *Hu_Ling_123@163.com*

Abstract—Our research has revealed two species of *Amandinea* (*A. occidentalis* and *A. polyspora*) and two species of *Buellia* (*B. morsina* and *B. penichra*), which we report for the first time from China. Descriptions of morphological and chemical characters are provided with the known distribution of each species.

Key words—*Caliciaceae*, *Caliciales*, corticolous, lichen-forming fungi, taxonomy

## Introduction

*Amandinea* M. Choisy ex Scheid. & M. Mayrhofer and *Buellia* De Not. (*Caliciaceae*, *Caliciales*, *Lecanoromycetes*, *Ascomycota*) are closely related genera characterized by a crustose thallus, apothecial ascomata, (4–)8 (–many)-spored asci, and brown 1-septate or (sub)muriform ascospores, with or without oil droplets in the hymenium (Foucard & al. 2002, Coppins & al. 2009). *Amandinea* can best be distinguished by the filiform conidia, ascospores with or without inner wall thickenings and clearly ornamented outer walls, and often lacking secondary metabolites detected by TLC, while species of *Buellia* s. lat. have bacilliform conidia and usually contain secondary compounds detectable by TLC (Coppins & al. 2009, Elix & Kantvilas 2013a,b, Giralt & al. 2015). *Amandinea* is represented by 81 species and *Buellia* 454 species worldwide (Giralt & Nordin 2002; Kirk & al. 2008; Şenkardeşler 2010; Giralt & al. 2011, 2015; Lumbsch & al. 2011;

---

[#] Xiao Zhang & Zun-Tian Zhao contributed equally to this research.

Giralt & van den Boom 2012; Fryday & Arcadia 2012; Tønsberg & al. 2012, Elix & Kantvilas 2013a,b, 2016a,b; Kondratyuk & al. 2013, 2015, 2016; Elix & al. 2015, 2017a,b, 2018; Blaha & al. 2016; Mayrhofer & al. 2016; Elix 2017a,b; Elix & Mayrhofer 2017, 2018). In China, only one *Amandinea* species and 53 *Buellia* species have been reported (Wei 1991, Watanuki & al. 2017, Wang & al. 2018).

This paper contributes to the knowledge of *Amandinea* and *Buellia* in China and affords accurate data for the Lichen Flora of China project. In this study we have identified four species new to the country: *Amandinea occidentalis*, *A. polyspora*, *Buellia morsina*, and *B. penichra.*

## Materials & methods

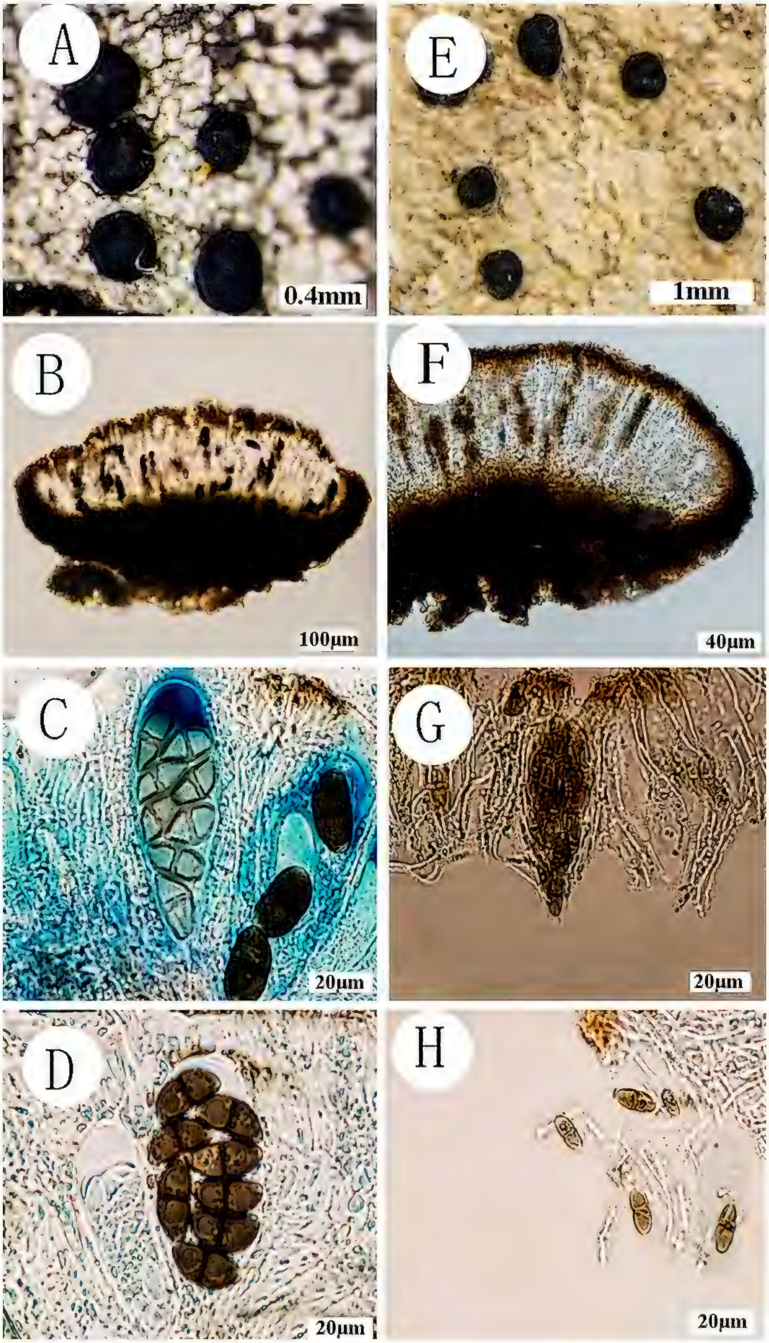
The specimens studied are preserved in the Lichen Section of Botanical Herbarium, Shandong Normal University, Jinan, China (SDNU). The specimens were examined morphologically and anatomically under a COIC XTL7045B2 stereo-microscope and a Olympus CX41 polarizing microscope. We tested the thallus and medulla of each specimen with K (10% aqueous KOH solution), C (aqueous ClNaO solution), and I (Lugol's iodine) for identification. Lichen substances were identified using standardized thin-layer chromatography techniques (TLC) with system C (Orange & al. 2010). The lichens were photographed using Olympus SZX16 and BX61 microscope with a DP72 lens.

## Taxonomy

***Amandinea occidentalis*** Elix & Kantvilas,
Australas. Lichenol. 72: 9 (2013) Fig. 1a–d

Thallus crustose, smooth, thin, areolate, pale greyish to white, esorediate. Prothallus present, but not apparent. Medulla white, I–. Apothecia black, 0.2–0.5 mm diam., sessile, epruinose, lecideine with a well developed margin, weakly concave at first, then plane to convex, scattered or crowded. Proper exciple dark brown, 50–70 µm wide; epihymenium olive-brown, K–; hymenium hyaline, inspersed with oil droplets; paraphyses simple; hypothecium dark brown, K–. Asci (4–)8-spored, *Bacidia*-type. Ascospores soon olive-brown, 1-septate, at first of the *Physconia*-type, then of the *Buellia*-type, broadly fusiform to ellipsoid, 23–28 × 9–11 µm, not constricted at the septum. Pycnidia not observed.

Fig. 1 ***Amandinea occidentalis*** (Wang 20181068, SDNU). A: Thallus with apothecia; B: Apothecium section; C: Ascus containing *Physconia*-type ascospores; D: Ascus containing *Buellia*-type ascospores. ***Amandinea polyspora*** (Cheng 20120079, SDNU). E: Thallus with apothecia; F: Apothecium section, without oil droplets in hymenium G: Ascus and ascospores; H: Ascospores.


A
0.4mm
E
1mm
B
100μm
F
40μm
C
20μm
G
20μm
D
20μm
H
20μm

Chemistry—Thallus K–, C–. No chemical substances detected by TLC.

Specimen examined: **CHINA. Yunnan, Shangri-La,** Mt. Tianbao, alt. 3700 m, on bark, 17 Aug. 2018, Chunxiao Wang 20181068 (SDNU).

Distribution—Australia (Western Australia, New South Wales) (Elix & Kantvilas 2013a; McCarthy 2018). New to China.

Comments—Our specimens are similar to previously published descriptions, except that the holotype has larger (0.2–1.2 mm) apothecia and usually 4-spored asci (Elix & Kantvilas 2013a). *Amandinea occidentalis* is characterized by the areolate thallus, *Physconia*-type to *Buellia*-type ascospores, a hymenium inspersed with oil droplets, and the absence of lichen substances. This species morphologically resembles *A. lignicola* var. *australis* Elix & Kantvilas, which is distinguished by often having a subsquamulose thallus, 8-spored asci with smaller ascospores (11–20 × 5–8 μm), and a non-inspersed hymenium (Elix & Kantvilas 2013a).

***Amandinea polyspora*** (Willey) E. Lay & P.F. May,
Bryologist 100(2): 164 (1997) Fig. 1e–h

Thallus corticate, smooth, thin, pale brown to yellowish brown, esorediate; medulla white, I–. Apothecia lecideine, black, 0.2–0.5 mm diam., sessile, epruinose, flat to convex, margin present at first but soon excluded. Proper exciple narrow, dark brown, 20–30 μm wide; epihymenium brown, pigmentation continuous with the outer exciple; hymenium hyaline, not inspersed with oil droplets; paraphyses simple to moderately branched, swollen at upper part, with a brown pigmented cap; hypothecium reddish brown. Asci *Bacidia*-type, mostly 16-spored, occasionally 32-spored. Ascospores soon brown, 1-septate, *Buellia*-type, oblong to ellipsoid, not constricted, 10–13(–15) × 4–5 μm. Pycnidia not seen.

Chemistry—Thallus K+ yellow, C–. Atranorin (trace) detected by TLC.

Specimen examined: **CHINA. Jilin, Helong,** Mt. Zengfeng, alt. 1600 m, on bark, 19 Aug. 2011, Yuliang Cheng 20120079 (SDNU).

Distribution—*Amandinea polyspora* has been reported from Korea (Kondratyuk & al. 2013) and from western, eastern, and southeastern USA (Bungartz & al. 2007). New to China.

Comments—Our specimens are similar to the protologue descriptions (Bungartz & al. 2007). *Amandinea polyspora* is characterized by the small ascospores and the polysporous asci. *Buellia schaereri* De Not. has similarly small ascospores but differs in its consistently 8-spored asci and bacilliform conidia, unlike the filiform conidia characteristic of *A. polyspora* (Bungartz & al. 2007).

***Buellia morsina*** A. Nordin, Symb. Bot. Upsal. 33(1): 74 (2000) Fig. 2a–c

Thallus crustose, smooth, rimose to areolate, brownish to grey, esorediate. Prothallus absent. Medulla white, I–. Apothecia lecideine, 0.7–1.5 mm diam.; sessile, disk black, epruinose, concave in young then flat; margin black, obvious in young apothecia. Proper exciple dark brown, 50–100 µm wide; epihymenium dark brown, K–, C–. hymenium colorless, 80–125 µm, not inspersed with oil droplets. Hypothecium dark brown. Asci 8-spored; ascospores soon brown, submuriform to muriform, 20–30 × 10–13 µm. Pycnidia not observed.

Chemistry—Thallus K+ yellow turning red. Norstictic acid, atranorin and connorstictic acid (trace) detected by TLC.

Specimen examined: **CHINA. Yunnan, Luquan**, Mt. Jiaozi, alt. 3600 m, on bark, 4 Nov. 2012, Hui Zhang 20129415 (SDNU).

Distribution—*Buellia morsina* has previously been reported from Mexico (Bungartz & al. 2007). New to China.

Comments—Our specimens are similar to previously published descriptions, except that the protologue describes smaller apothecia (0.2–1.2 mm) and the presence of a black prothallus (Bungartz & al. 2007). *Buellia morsina* is characterized by its submuriform to muriform ascospores and the presence of norstictic acid, atranorin, and connorstictic acid (trace). Its thallus morphology, secondary chemistry, and exciple anatomy are similar to *B. lauri-cassiae* (Fée) Müll. Arg., which is distinguished by its smaller, 3-septate spores (Nordin 2000, Giralt & Nordin 2002, Bungartz & al. 2007).

***Buellia penichra*** (Tuck.) Hasse, Contr. U.S. Natl. Herb. 17: 122 (1913) Fig. 2d–f

Thallus corticate, smooth, greyish white, rimose to dispersed areolate. Prothallus black. Medulla white, I–. Apothecia lecideine, black, round, 0.4–0.8 mm diam., sessile, dispersed, flat at first soon convex, disc epruinose; margin black, distinct in young apothecia, later excluded. Proper exciple brown, pigmentation continuous with the outer exciple; epihymenium brown to dark green; hymenium hyaline, inspersed with oil droplets, paraphyses simple with distinct apical cap; hypothecium dark brown to dark green. Asci 8-spored, ascospores submuriform, pale green then brown, broadly fusiform to ellipsoid, 25–28 × 10–13 µm. Pycnidia not observed.

Chemistry—Thallus K+ yellow, C–. Atranorin detected by TLC.

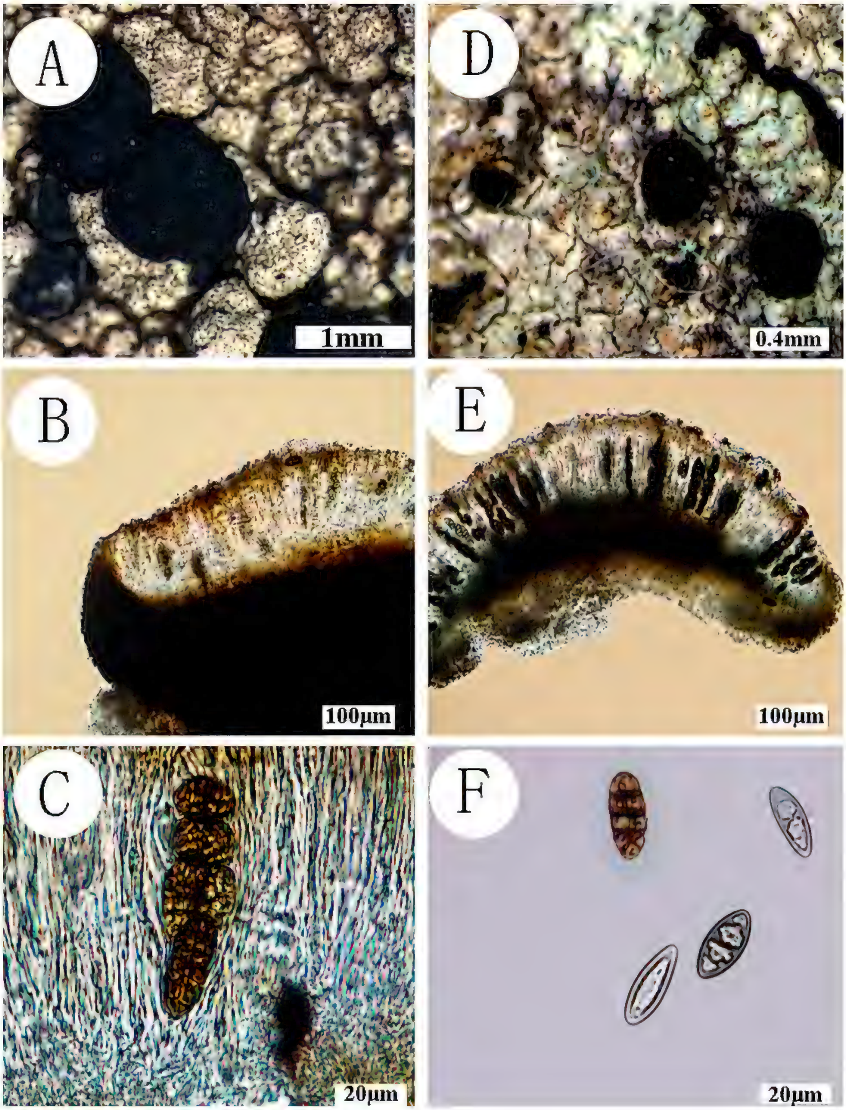


Fig. 2 ***Buellia morsina*** (Zhang 20129415, SDNU). A: Thallus with apothecia; B: Apothecium section; C: Ascus and ascospores. ***Buellia penichra*** (Wang 20181108, SDNU). D: Thallus with apothecia; E: Apothecium section; F: Ascospores, showing stages of development.

Specimens examined: **CHINA. Yunnan, Shangri-La**, Mt. Tianbao, alt. 3790 m, on bark, 17 Aug. 2018, Chunxiao Wang 20181131 (SDNU); alt. 3845 m, on bark, 17 Aug. 2018, Chunxiao Wang 20181108 (SDNU).

Distribution—Western North America (Rocky Mountains) (Bungartz & al. 2007). New to China.

Comments—The protologue describes *Buellia penichra* as containing atranorin and sometimes placodiolic acid (Bungartz & al. 2007), but our specimens contain only atranorin. This species is characterized by the submuriform spores lacking a perispore and presence of atranorin. *Buellia penichra* might be confused with *B. muriformis* A. Nordin & Tønsberg on the basis of its ascospores lacking a perispore, but *B. muriformis* differs in its secondary chemistry (containing placodiolic acid, atranorin, isousnic acid, brialmontin 1 and brialmontin 2) and larger (25–39 × 13–18 μm) ascospores (Nordin 1999).

## Acknowledgements

The authors thank Dr. John A. Elix (Australian National University, Canberra) and Dr. Shou-Yu Guo (State Key Laboratory of Mycology, Chinese Academy of Sciences, Beijing) for guidance in specimen identification and presubmission reviews. We also thank Shu-Kun Yan and other laboratory members for assistance during this study. This investigation was supported by the Emergency Management Project of National Natural Science Foundation of China (31750001), the National Natural Science Foundation of China (31600100) and the Scientific Research Foundation of Graduate School of Shandong Normal University (SCX201945).

## Literature cited

Blaha J, Mayrhofer H, Elix JA. 2016. Five new saxicolous species of *Amandinea* (*Ascomycota, Physciaceae*) from New Zealand and southern Australia. Australasian Lichenology 79: 35–49.

Bungartz F, Nordin A, Grube U. 2007. *Buellia* De Not. 113–179, in: TH Nash III & al. (eds). Lichen Flora of the Greater Sonoran Desert Region, vol. 3. Tempe, Lichens Unlimited, Arizona State University.

Coppins BJ, Scheidegger C, Aptroot A. 2009. *Buellia* de Not. (1846). 238–239, in: CW Smith & al. (eds). The lichens of Great Britain and Ireland. London, British Lichen Society. https://doi.org/10.1017/S0024282909990521

Elix JA. 2017a. Two new species and new records of buellioid lichens (*Caliciaceae*, *Ascomycota*) from Macquarie Island. Australasian Lichenology 81: 6–11.

Elix JA. 2017b. Three new species and eight new records of saxicolous buellioid lichens (*Caliciaceae*, *Ascomycota*) from New Zealand's Subantarctic Islands. Australasian Lichenology 81: 68–78

Elix JA, Kantvilas G. 2013a. New taxa and new records of *Amandinea* (*Physciaceae*, *Ascomycota*) in Australia. Australasian Lichenology 72: 3–19.

Elix JA, Kantvilas G. 2013b. New taxa and new records of *Buellia* sensu lato (*Physciaceae*, *Ascomycota*) in Australia. Australasian Lichenology 73: 24–44.

Elix JA, Kantvilas G. 2016a. *Amandinea coniops* (*Physciaceae*, *Ascomycota*) and its mimics in Tasmania and New Zealand. Australasian Lichenology 78: 22–31.

Elix JA, Kantvilas G. 2016b. New species and new records of buellioid lichens (*Ascomycota*, *Physciaceae*) in Tasmania. Australasian Lichenology 79: 26–34.

Elix JA, Mayrhofer H. 2017. New species and new records of buellioid lichens (*Physciaceae*, *Ascomycota*) from New Zealand. Telopea 20: 75–84. https://doi.org/10.7751/telopea11334.

Elix JA, Mayrhofer H. 2018. Three new species and ten new records of buellioid lichens (*Ascomycota*, *Caliciaceae*) from New Zealand. Australasian Lichenology 82: 68–79.

Elix JA, Malcolm WM, Knight A. 2015. New records and new combinations of buellioid lichens (*Physciaceae*, *Ascomycota*) from New Zealand. Australasian Lichenology 77: 36–41.

Elix JA, Kantvilas G, McCarthy PM. 2017a. Thirteen new species and a key to buellioid lichens (*Caliciaceae*, *Ascomycota*) in Australia. Australasian Lichenology 81: 26–67.

Elix JA, Mayrhofer H, McCarthy PM. 2017b. New species and a new record of buellioid lichens (*Physciaceae*, *Ascomycota*) from Australia. Australasian Lichenology 80: 28–37.

Elix JA, Mayrhofer H, Rodriguez JM. 2018. Two new species, a new combination and four new records of saxicolous buellioid lichens (*Ascomycota*, *Caliciaceae*) from southern South America. Australasian Lichenology 83: 3–13.

Foucard T, Mayrhofer H, Moberg R, Nordin A. 2002. Nordic lichen flora, vol. 2. Svenska Botaniska Föreningen.

Fryday AM, Arcadia L. 2012. Typification and revised basionym for *Fuscidea lygaea*, and a new name for *Amandinea lecideina*. Graphis Scripta 24(2): 40–44.

Giralt M, Nordin A. 2002. *Buellia triseptata* in the Iberian Peninsula. Lichenologist 34(2): 89–94. https://doi.org/10.1006/lich.2002.0375

Giralt M, van den Boom PPG. 2012. Checklist and three new species of lichens and lichenicolous fungi of the Algarve (Portugal). Sydowia 64(2): 149–208.

Giralt M, van den Boom PPG, Elix JA. 2011. *Amandinea myrticola*, a new corticolous species from Portugal. Lichenologist 43(3): 193–197. https://doi.org/10.1017/S0024282911000120

Giralt M, van den Boom PPG, Elix JA. 2015. *Amandinea lobarica*, a new corticolous species from Guatemala, with notes on some additional *Amandinea* taxa. Lichenologist 47(4): 257–268. https://doi.org/10.1017/S0024282915000158

Kirk PM, Cannon PF, Minter DW, Stalpers JA (eds). 2008. Dictionary of the fungi, 10th edition. CAB International, Wallingford.

Kondratyuk SY, Lőkös L, Tschabanenko S, Moniri MH, Farkas E, Wang SY, Oh SO, Hur JS. 2013. New and noteworthy lichen-forming and lichenicolous fungi. Acta Botanica Hungarica 55(3–4): 275–349. https://doi.org/10.1556/abot.55.2013.3-4.9

Kondratyuk SY, Lőkös L, Farkas E, Oh SO, Hur, JS. 2015. New and noteworthy lichen-forming and lichenicolous fungi 3. Acta Botanica Hungarica 57(3–4): 345–382. https://doi.org/10.1556/034.57.2015.3-4.7

Kondratyuk SY, Lőkös L, Halda JP, Upreti DK, Mishra GK, Moniri MH, Farkas E, Park JS, Lee BG, Liu D, Woo JJ, Jayalal RGU, Oh SO, Hur, JS. 2016. New and noteworthy lichen-forming and lichenicolous fungi: 5. Acta Botanica Hungarica 58(3–4): 319–396. https://doi.org/10.1556/abot.58.2016.3-4.7

Lumbsch T, Ahti T, Altermann S, Arup U & al. 2011. One hundred new species of lichenized fungi: a signature of undiscovered global diversity. Phytotaxa 18(1). 127 p.

Mayrhofer H, Ropin K, Elix JA. 2016. Two new corticolous species of *Amandinea* (*Ascomycota*, *Physciaceae*) from New Zealand. Australasian Lichenology 78: 11–12.

McCarthy PM. 2018. Checklist of the lichens of Australia and its island territories. Australian Biological Resources Study, Canberra. Version 17 May 2018.
https://www.anbg.gov.au/abrs/lichenlist/introduction.html

Nordin A. 1999. *Buellia* species with pluriseptate spores: new and unrecorded species in North America. Bryologist 102(2): 249–264. https://doi.org/10.2307/3244364

Nordin A. 2000. Taxonomy and phylogeny of *Buellia* species with pluriseptate spores (*Lecanorales*, *Ascomycotina*). Symbolae Botanicae Upsalienses 33(1). 117 p.

Orange A, James PW, White FJ. 2010. Microchemical methods for the identification of lichens. 2nd edition. London, British Lichen Society.

Şenkardeşler A. 2010. Additions and corrections of types in the genus *Buellia* s. lat. (*Physciaceae*) described by J. Steiner. Lichenologist 42(4): 439–448. https://doi.org/10.1017/S0024282910000241

Tønsberg T, Nordin A, Tibell L. 2012. *Amandinea lignicola*, a new species from the Pacific coast of North America. Graphis Scripta 24(2): 60–64.

Wang QD, Liu FY, Wu XH, Zhao X, Jia ZF. 2018. *Buellia taishanensis* sp. nov. and new *Buellia* records from Mt. Tai, China. Mycosystema 133: 165–172. https://doi.org/10.5248/133.165

Watanuki O, Hara K, Harada H, Komine M, Fuji S. 2017. *Buellia numerosa* and *B. subnumerosa*, two new species of the lichen genus *Buellia* (*Caliciaceae*) from Japan. Bryologist 120(1): 25–36. https://doi.org/10.1639/0007-2745-120.1.025

Wei JC. 1991. An enumeration of lichens in China. Beijing, International Academic Publishers. 278 p.